Update on Mass shifts

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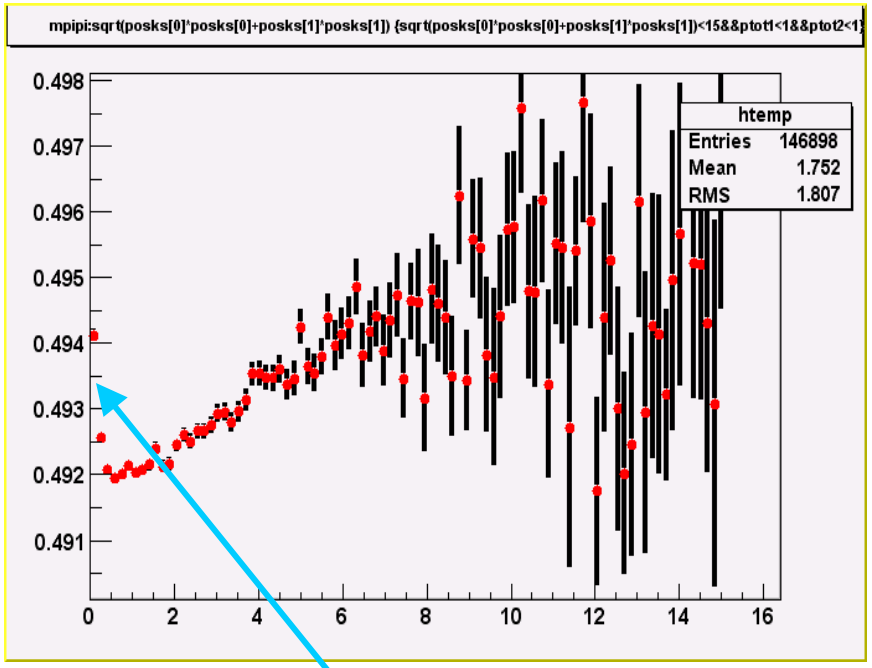
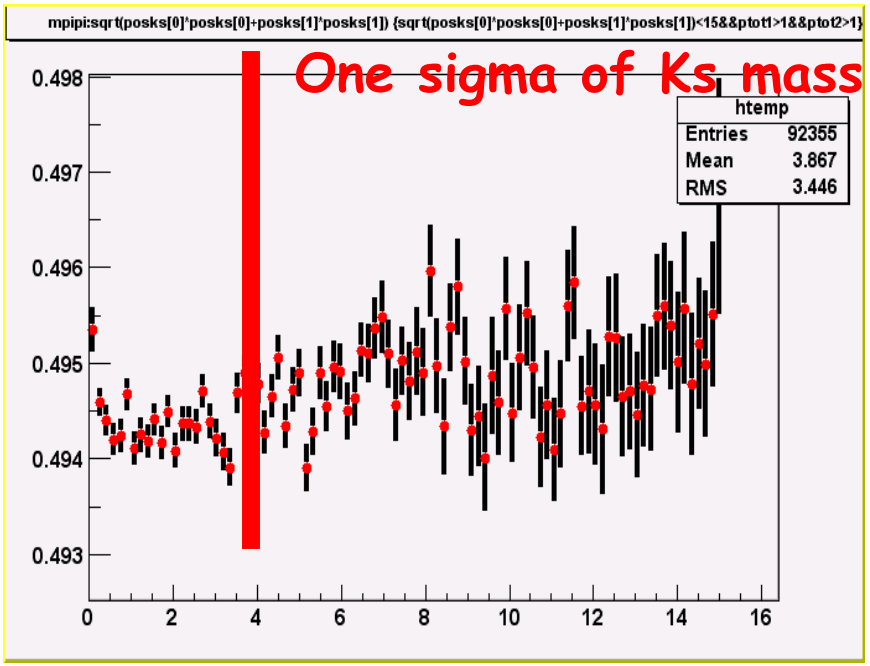
- Have large sample of V0
  - 6M Ks, 1M Lambdas, 2.7M gamma conversions
  - Used ~ random set of p14 data, all triggers, L<10 pb-1
  - Use custom rootuple created by AATrack package running off TMB in the framework
- Will show here
  - Ks mass versus radius
  - Ks mass versus momentum
  - Ks & J/psi mass versus material
  - First look at corrections
  - Lambdas

Ks mass dependence on decay radius

Low momenta pions: (P<1GeV)

High momenta pions: (P>1GeV)

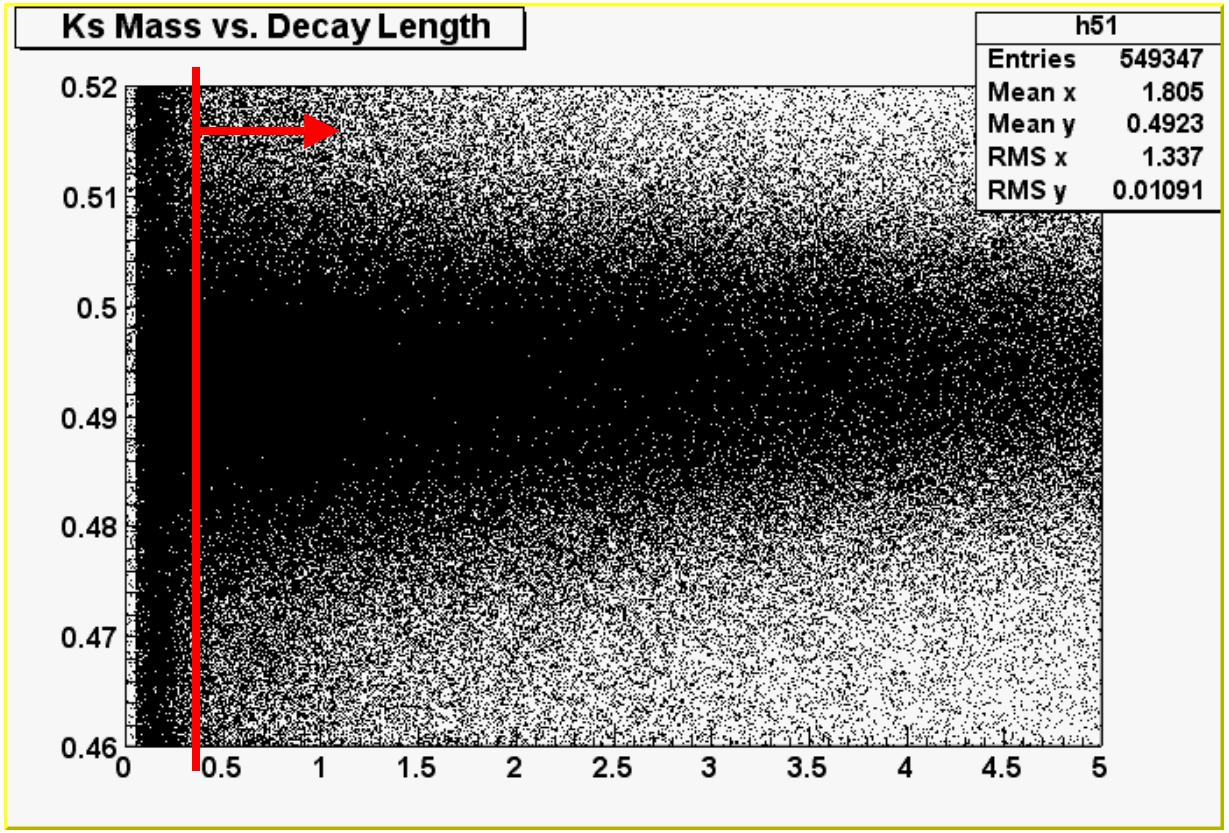




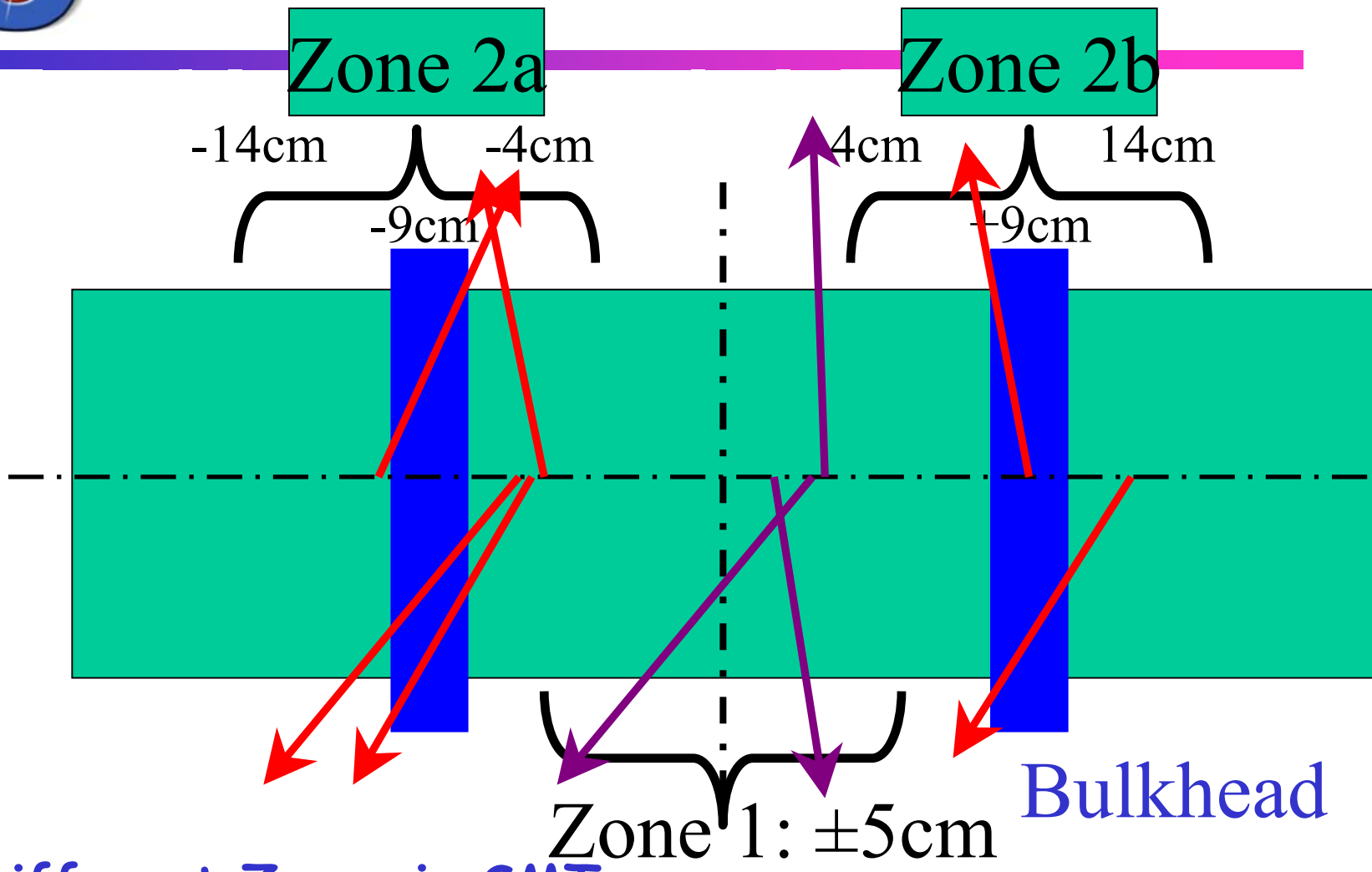
- Higher momentum tracks are less affected
- See next slide re this area

Ks mass vs. radius again

- Small R has some background
  - Use R>4mm



Dependence on material

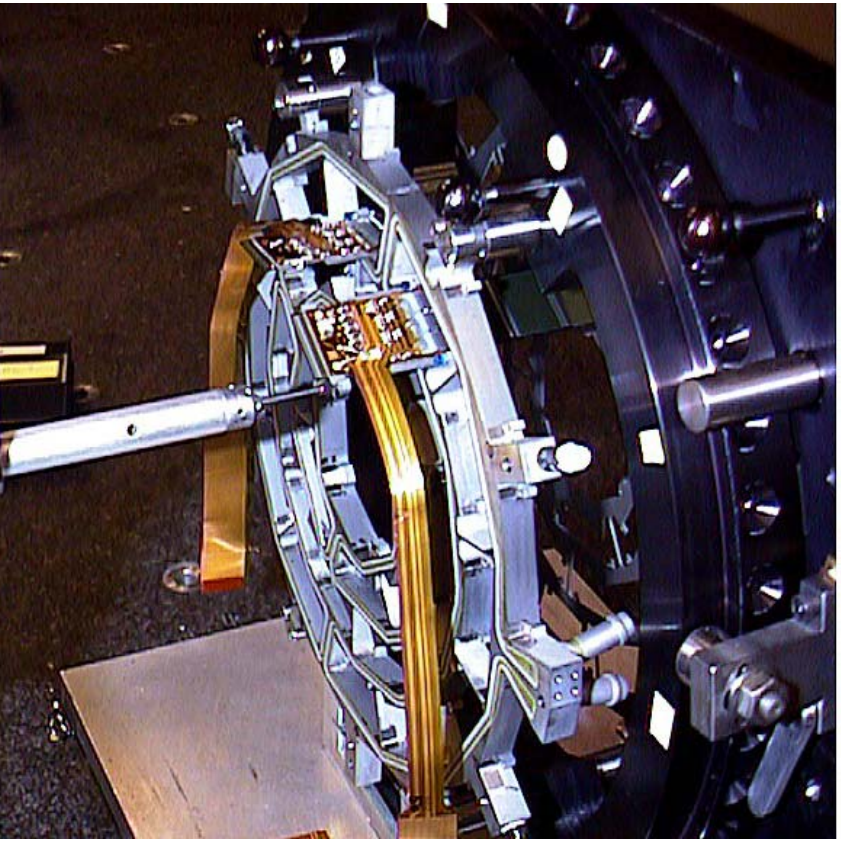


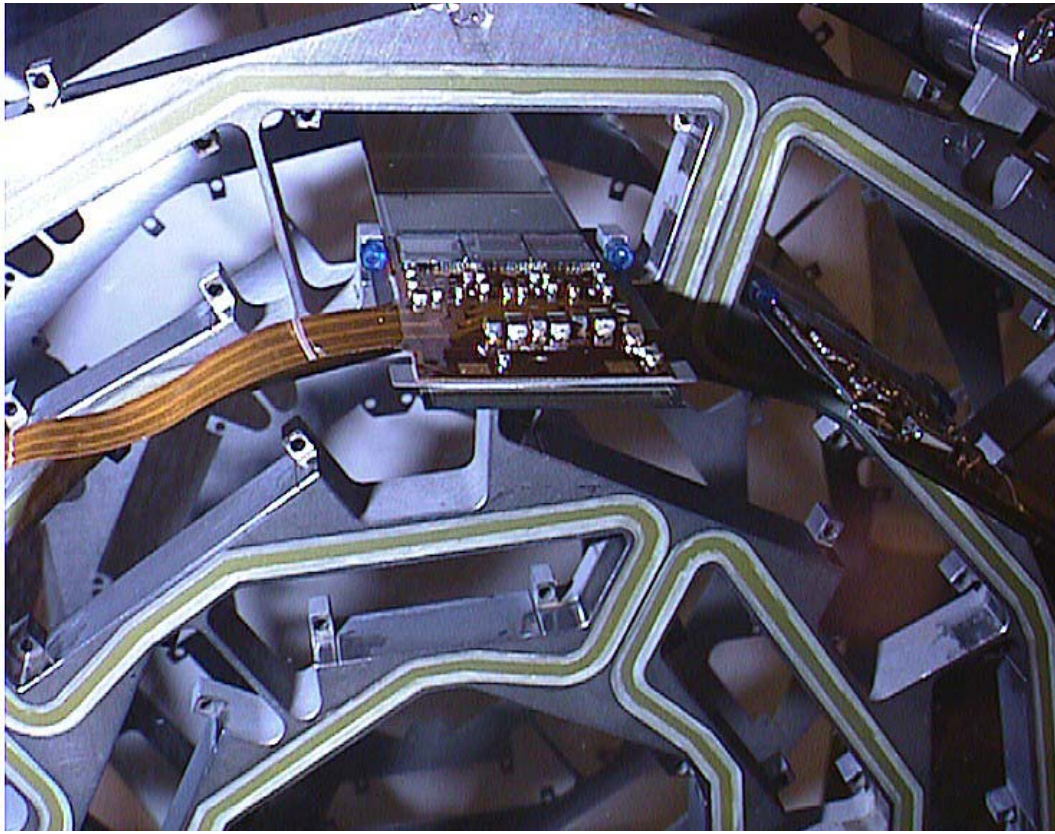
Select Different Zones in SMT

- No bulkheads crossed (zone 1)
- Bulkhead crossed (zones 2a & 2b)

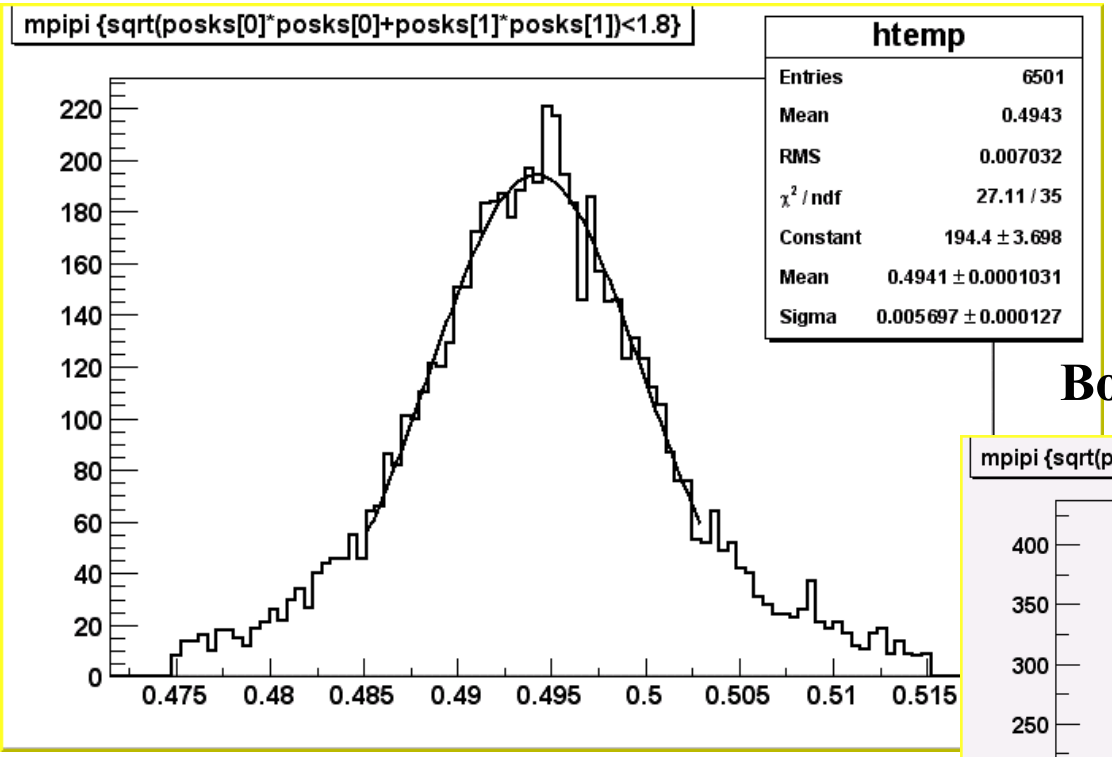
SMT Bulkheads

- Support silicon ladders
- Made of beryllium
- Have integrated cooling



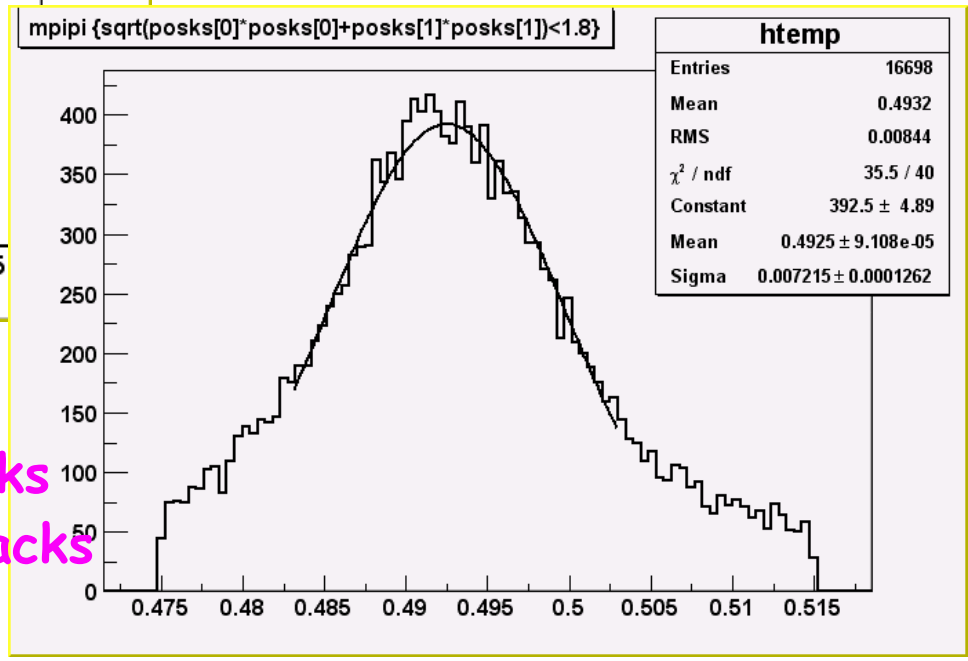


Ks mass



Both tracks are central (Zone 1)

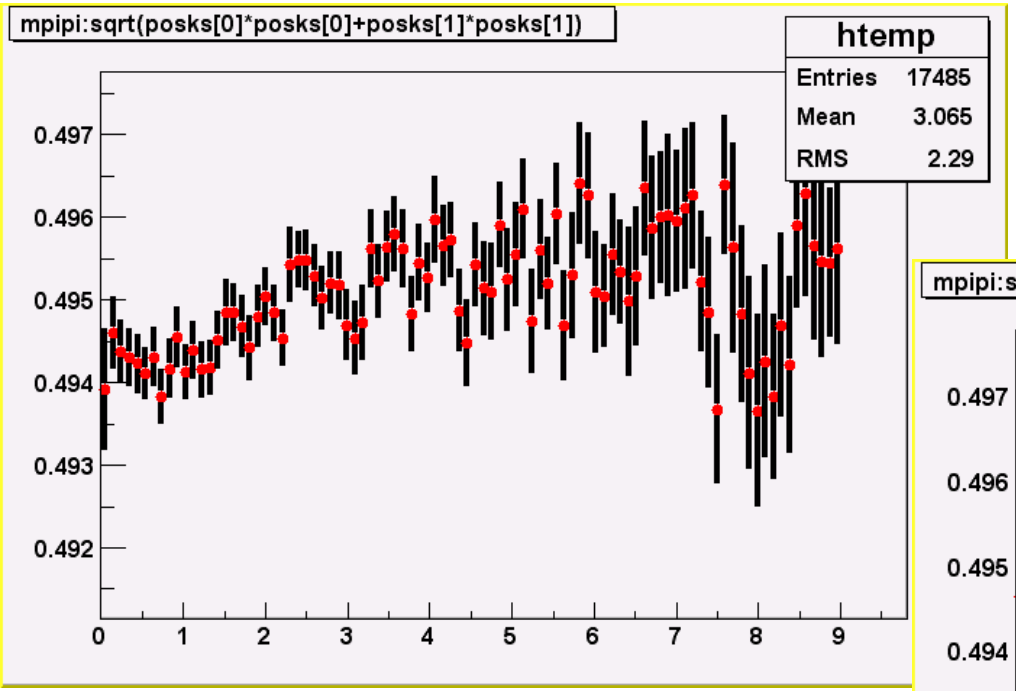
Both tracks are in bulkhead (Zone 2)



- 494.1+-5.7 MeV for central tracks
- 492.5+-7.2 MeV for bulkhead tracks

+ more tails

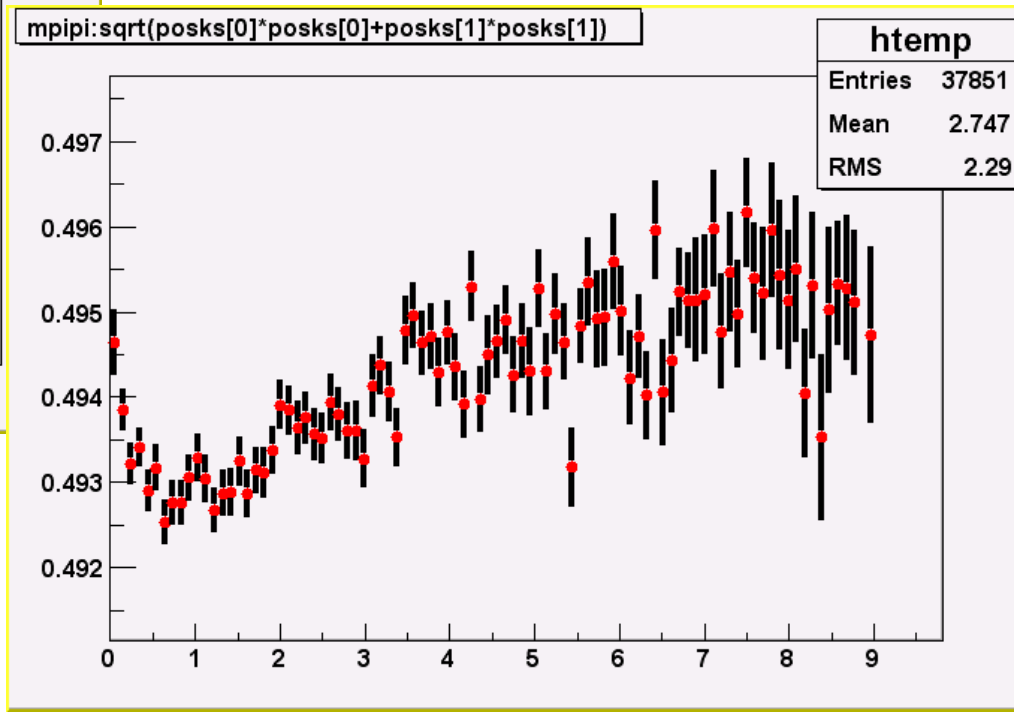
Ks mass dependence on decay radius



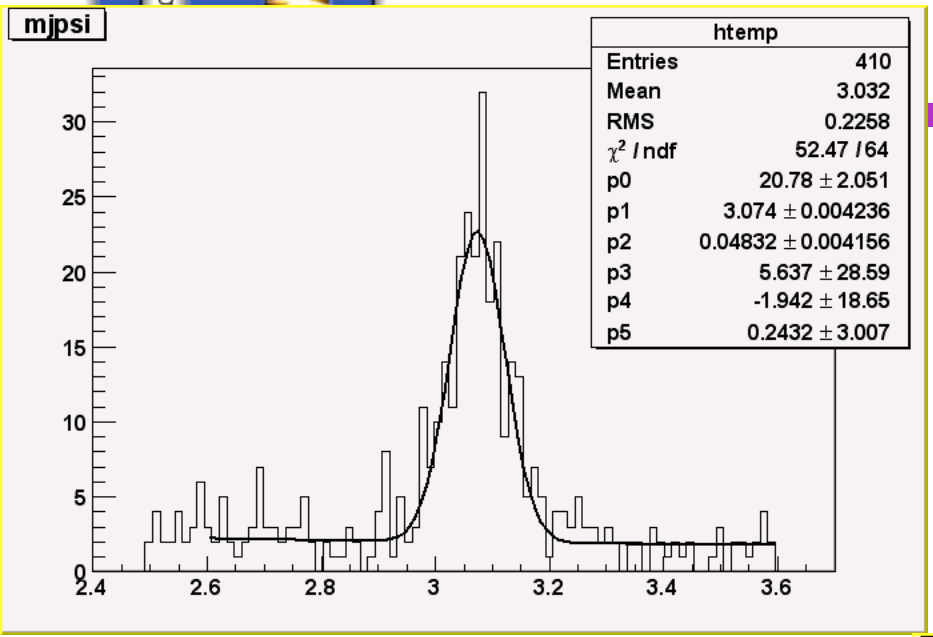
Both tracks are central (Zone 1)

Tracks going through less material are less affected

Both tracks are in bulkhead (Zone 2)



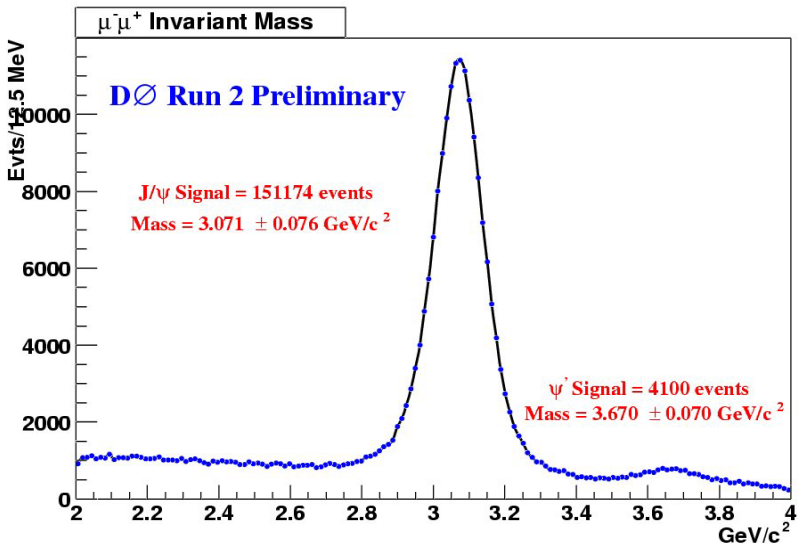
$M_{J/\psi}$

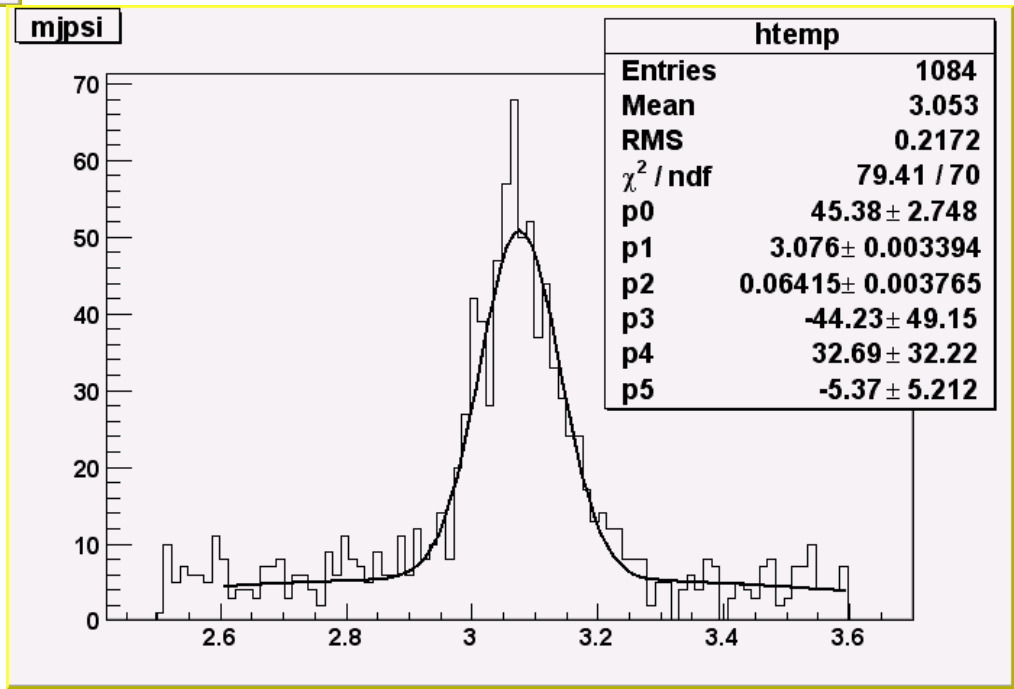


- 3074+-48 MeV for central tracks
- 3076+-64 MeV for bulkhead tracks
- Averaged over everything : sigma = 71 MeV

Both tracks are in bulkhead (Zone 2)

Both tracks are central (Zone 1)





Mass corrections for Ks

- First look at mass corrections
- Should consider at least two effects
  - dEdx in extra material => additional term to E
  - Scale factor for B field => scaling of Pt

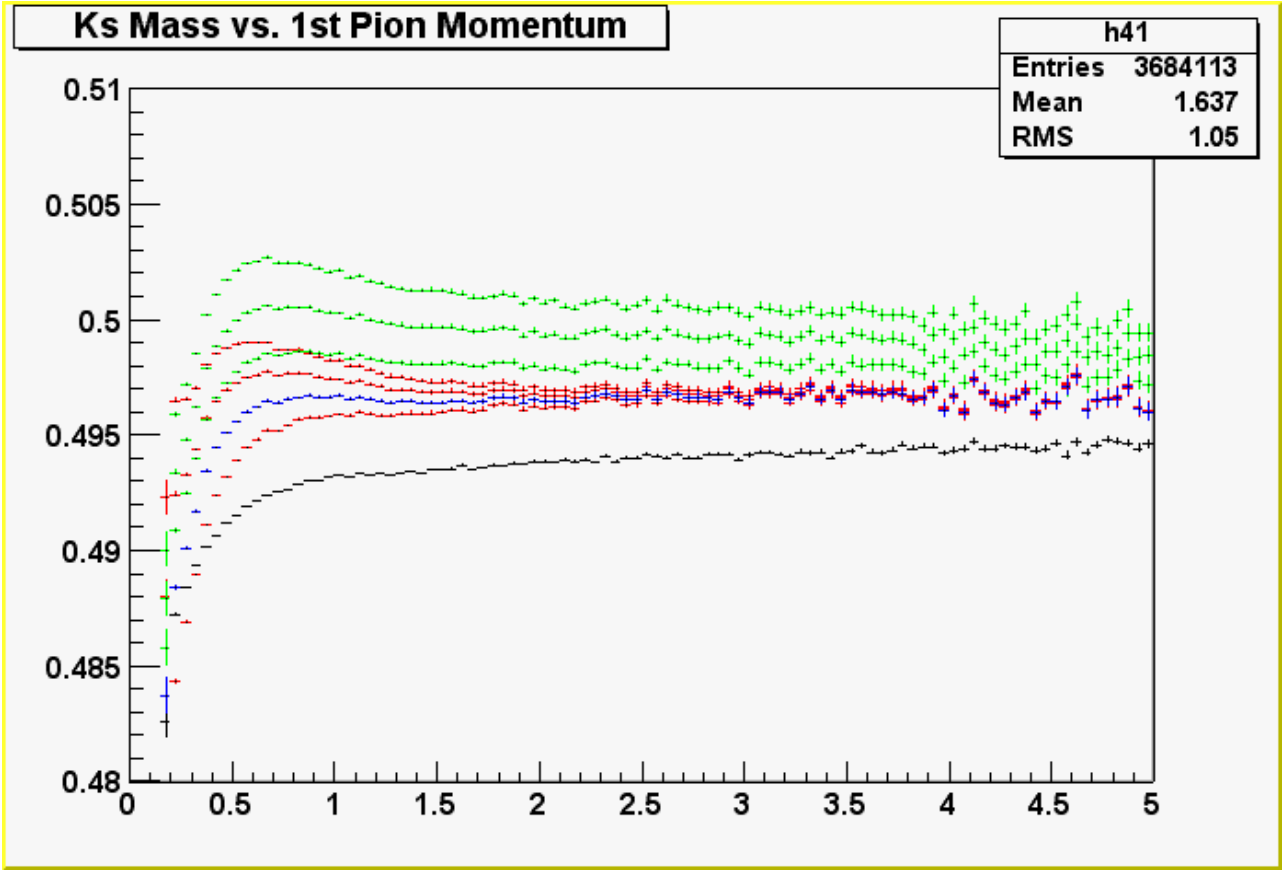
Black curve : mass from V0 package

Blue curve : corrections = 0

Red curves : E corrected in steps of +-2 MeV

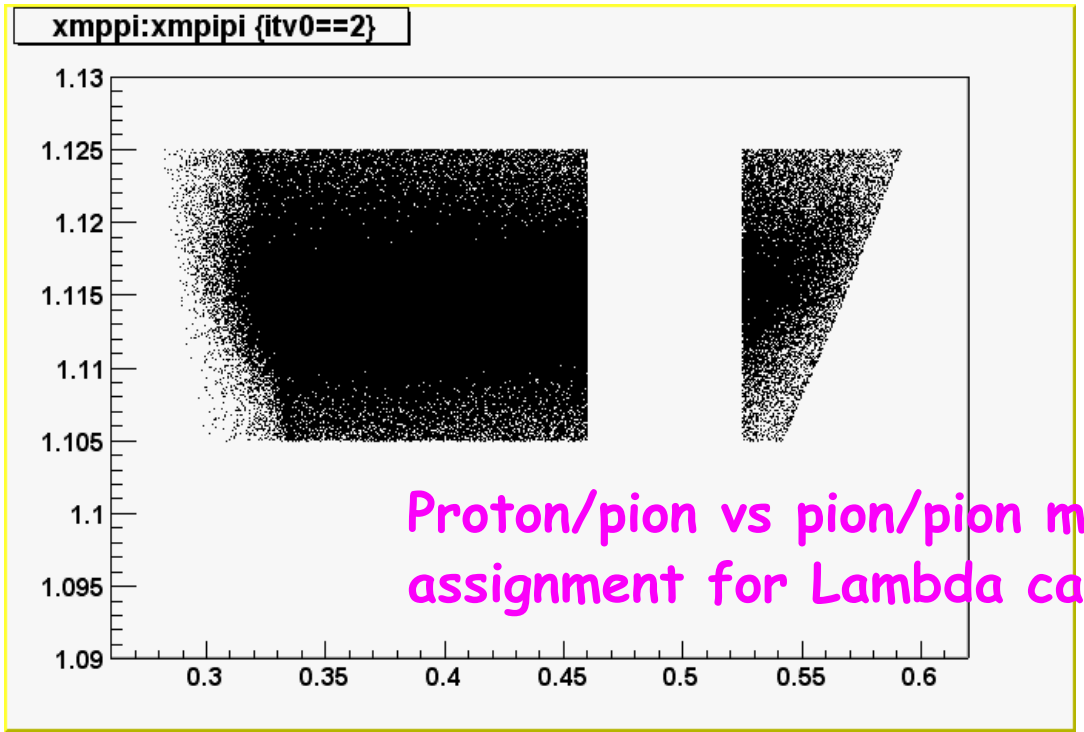
Green curves : Pt scaling in steps of +1%

(caution: black!=blue because used wrong momenta – to be fixed)



Lambda mass

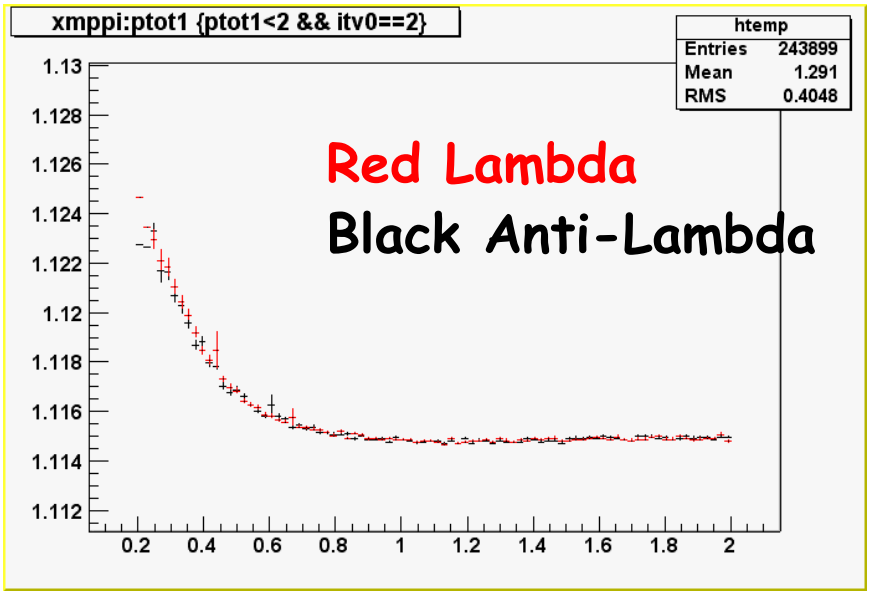
- Mass resolution ~ 3 MeV, almost no mass shift
- Less sensitive because of kinematics, q=101 MeV
- Have few things to understand
  - In AATrack two tracks are considered a Lambda candidate after Ks -> some distributions are sculptured by Ks mass window cut. Will be fixed.

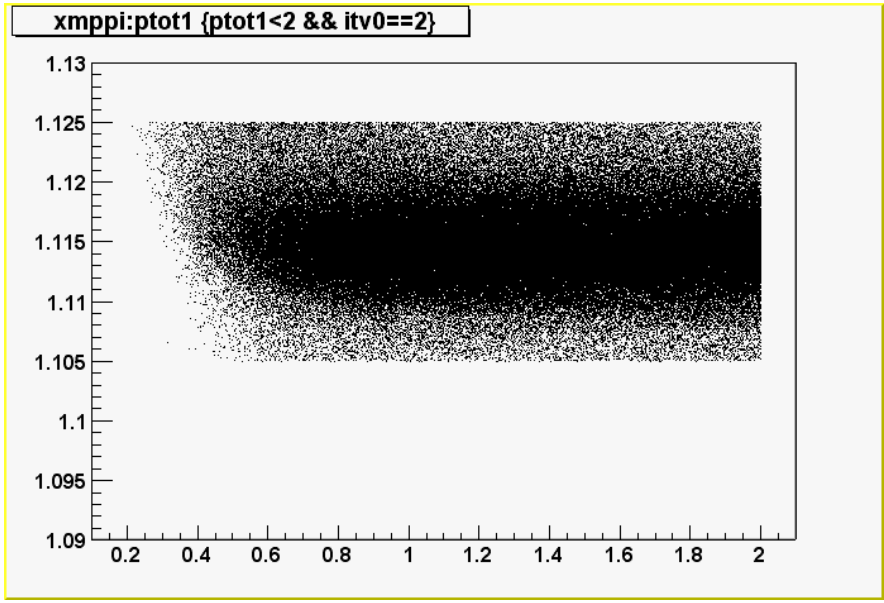


Proton/pion vs pion/pion mass assignment for Lambda candidates

Lambda mass

- Mass vs. P_proton has different behavior than Ks mass. so far a mystery.





Plans

- Accumulate evidence, try to understand it – in progress
  - Study mass as function of momentum, decay radius, geometry, type of particle, compare data/MC etc
- Measure necessary B and/or dEdx corrections - how to disentangle them?
  - Use J/psi sample : more energetic particles =>
    - less dependent on dEdx, no hadronic interactions
    - J/psi mass scales with B (muon mass is small wrt momenta)
  - Study rad corrections to J/psi peak in MC
  - Study dEdx corrections in MC (in principle GTR propagator should treat it correctly so no corrections are necessary)
  - Study additional material needed to have no slope in the mass dependence versus momenta
  - Declare that B corrections are responsible for the rest of mass discrepancy and scale the B field accordingly
  - Apply to all other resonances (Ks, Ypsilon, D0, Ds) as double check

Plans (cnt'd)

- How to use conversions?
  - Can have very accurate description of material
  - Difficulty
    1. Depends as Z^2 on material atomic number while dEdx depends as Z
    2. How to normalize? CDF for ex used Al cover of drift chamber known with high accuracy for normalization.

- **Short term plans**
  - Add J/psi & Ypsilons to our V0 Rootuple
  - Look at MC
- **Longer term**
  - Implementation within existing tracking software
  - Understand/improve mass resolutions
    - S/B ratio for all signals
    - Important for separation of ypsilons (1S,2S,..) and other peaks
- **Agreed that this work will be coordinated by Tracking group**

Image of Tracker from γ-conversions